

## Ultrafast recovery - high voltage diode

### Main product characteristics

I <sub>F(AV)</sub>	30 A
V <sub>RRM</sub>	1000 V
T <sub>j</sub>	175° C
V <sub>F</sub> (typ)	1.30 V
t <sub>rr</sub> (typ)	42 ns

### Features and benefits

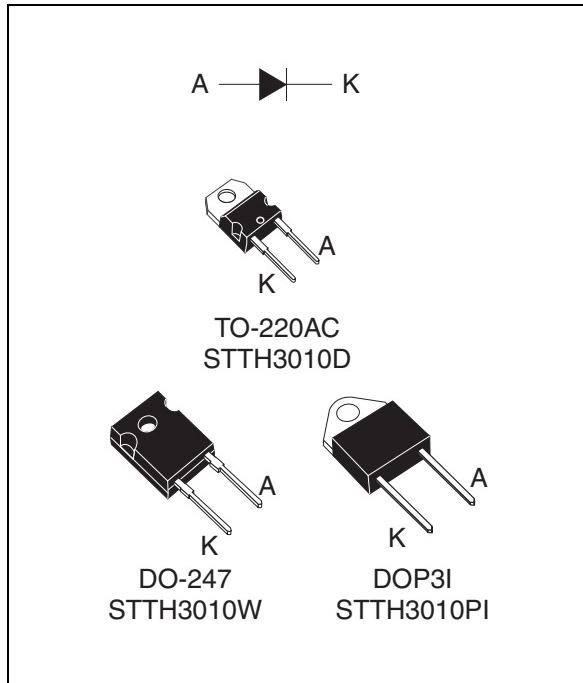
- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- High junction temperature
- Insulated package:
  - DOP3I  
Electrical insulation = 2500 V<sub>RMS</sub>  
Capacitance = 12 pF

### Description

The high quality design of this diode has produced a device with low leakage current, regularly reproducible characteristics and intrinsic ruggedness. These characteristics make it ideal for heavy duty applications that demand long term reliability.

Such demanding applications include industrial power supplies, motor control, and similar mission-critical systems that require rectification and freewheeling. These diodes also fit into auxiliary functions such as snubber, bootstrap, and demagnetization applications.

The improved performance in low leakage current, and therefore thermal runaway guard band, is an immediate competitive advantage for this device.



### Order codes

Part Number	Marking
STTH3010D	STTH3010D
STTH3010W	STTH3010W
STTH3010PI	STTH3010PI

# 1 Characteristics

**Table 1. Absolute ratings (limiting values at 25° C, unless otherwise specified)**

Symbol	Parameter			Value	Unit
V <sub>RRM</sub>	Repetitive peak reverse voltage			1000	V
I <sub>F(RMS)</sub>	RMS forward current			50	A
I <sub>F(AV)</sub>	Average forward current, $\delta = 0.5$	TO-220 / DO-247	T <sub>c</sub> = 105° C	30	A
		DOP3I	T <sub>c</sub> = 65° C		
I <sub>FRM</sub>	Repetitive peak forward current	t <sub>p</sub> = 5 µs, F = 5 kHz square		300	A
I <sub>FSM</sub>	Surge non repetitive forward current	t <sub>p</sub> = 10 ms Sinusoidal		180	A
T <sub>stg</sub>	Storage temperature range			-65 to + 175	°C
T <sub>j</sub>	Maximum operating junction temperature			175	°C

**Table 2. Thermal parameters**

Symbol	Parameter		Value	Unit
R <sub>th(j-c)</sub>	Junction to case	TO-220 / DO-247	1.1	°C/W
		DOP3I	1.8	

**Table 3. Static electrical characteristics**

Symbol	Parameter	Test conditions		Min.	Typ	Max.	Unit
I <sub>R</sub> <sup>(1)</sup>	Reverse leakage current	T <sub>j</sub> = 25° C	V <sub>R</sub> = V <sub>RRM</sub>			15	µA
		T <sub>j</sub> = 125° C			10	100	
V <sub>F</sub> <sup>(2)</sup>	Forward voltage drop	T <sub>j</sub> = 25° C	I <sub>F</sub> = 30 A			2	V
		T <sub>j</sub> = 100° C			1.4	1.8	
		T <sub>j</sub> = 150° C			1.3	1.7	

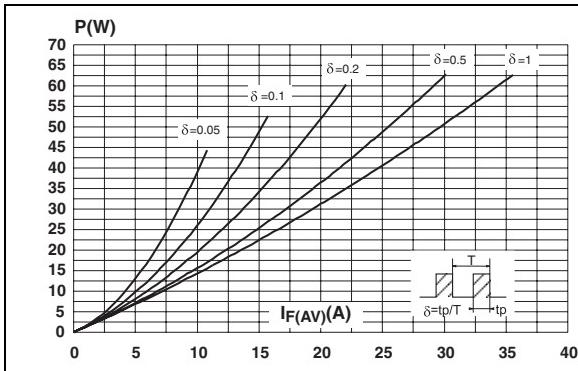
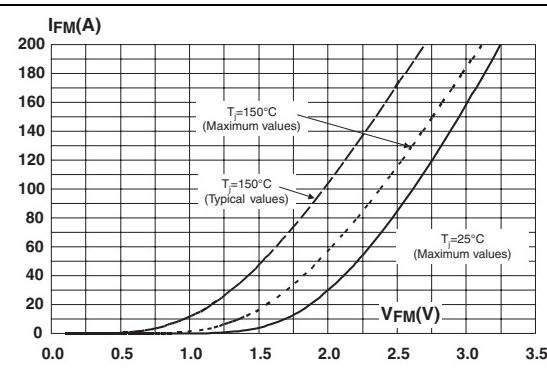
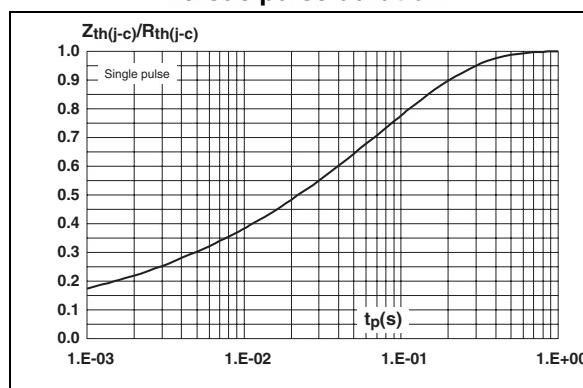
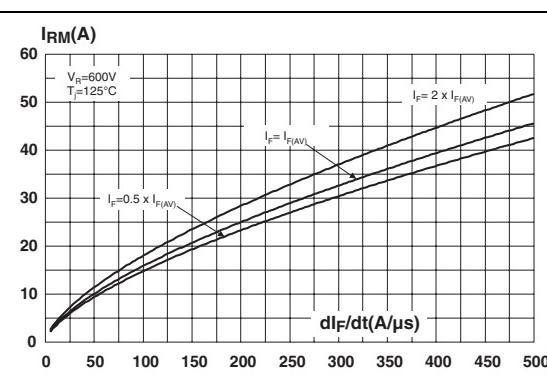
1. Pulse test: t<sub>p</sub> = 5 ms, δ < 2 %2. Pulse test: t<sub>p</sub> = 380 µs, δ < 2 %

To evaluate the conduction losses use the following equation:

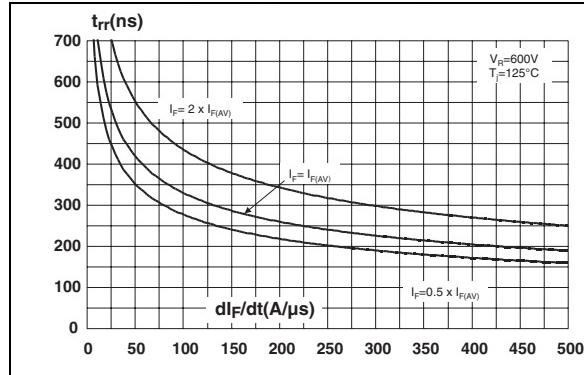
$$P = 1.3 \times I_{F(AV)} + 0.013 I_{F(RMS)}^2$$

**Table 4. Dynamic characteristics**

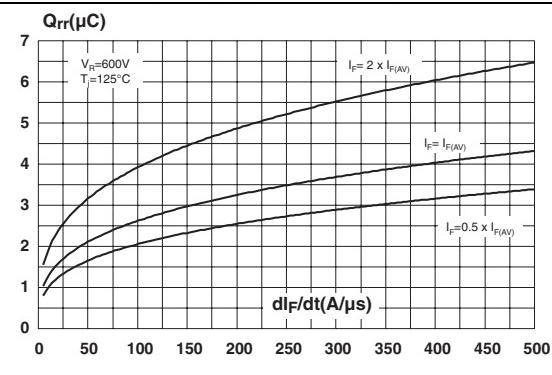
Symbol	Parameter	Test conditions	Min.	Typ	Max.	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1 \text{ A}, dI_F/dt = -50 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}, T_j = 25^\circ \text{C}$			100	ns
		$I_F = 1 \text{ A}, dI_F/dt = -100 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}, T_j = 25^\circ \text{C}$		53	70	
		$I_F = 1 \text{ A}, dI_F/dt = -200 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}, T_j = 25^\circ \text{C}$		42	55	
$I_{RM}$	Reverse recovery current	$I_F = 30 \text{ A}, dI_F/dt = -200 \text{ A}/\mu\text{s}, V_R = 600 \text{ V}, T_j = 125^\circ \text{C}$		24	32	A
S	Softness factor	$I_F = 30 \text{ A}, dI_F/dt = -200 \text{ A}/\mu\text{s}, V_R = 600 \text{ V}, T_j = 125^\circ \text{C}$		1		
$t_{fr}$	Forward recovery time	$I_F = 30 \text{ A}, dI_F/dt = 100 \text{ A}/\mu\text{s}, V_{FR} = 1.5 \times V_{Fmax}, T_j = 25^\circ \text{C}$			450	ns
$V_{FP}$	Forward recovery voltage	$I_F = 30 \text{ A}, dI_F/dt = 100 \text{ A}/\mu\text{s}, T_j = 25^\circ \text{C}$		5		V

**Figure 1. Conduction losses versus average current****Figure 2. Forward voltage drop versus forward current****Figure 3. Relative variation of thermal impedance junction to case versus pulse duration****Figure 4. Peak reverse recovery current versus dI\_F/dt (typical values)**

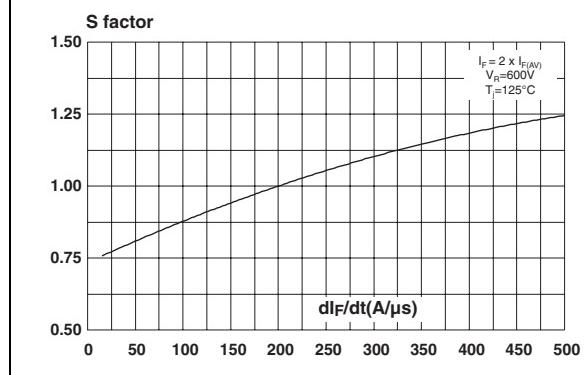
**Figure 5. Reverse recovery time versus  $dI_F/dt$  (typical values)**



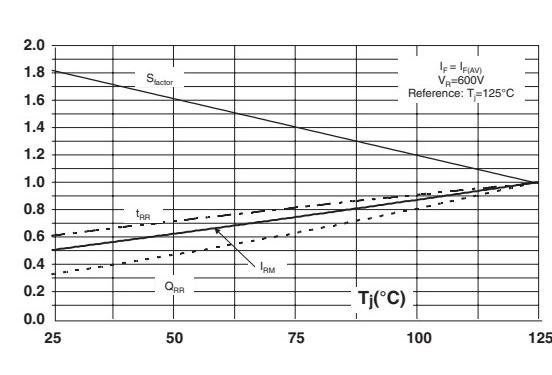
**Figure 6. Reverse recovery charges versus  $dI_F/dt$  (typical values)**



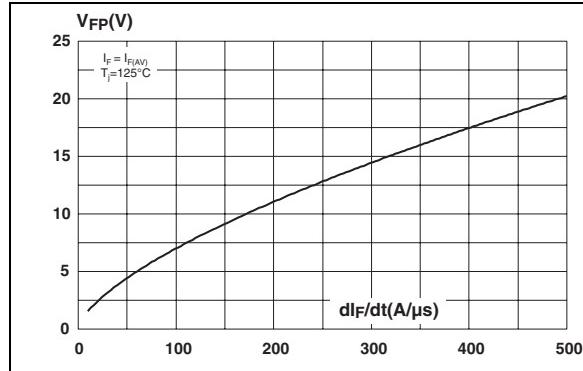
**Figure 7. Softness factor versus  $dI_F/dt$  (typical values)**



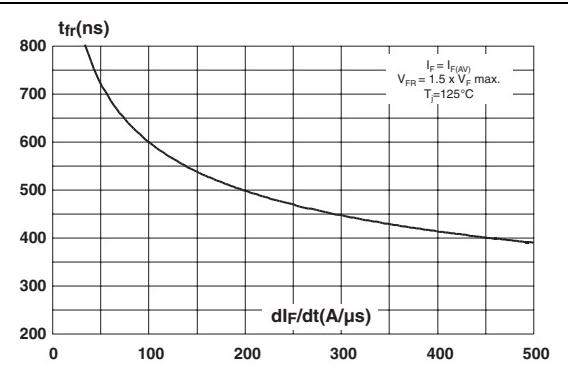
**Figure 8. Relative variations of dynamic parameters versus junction temperature**



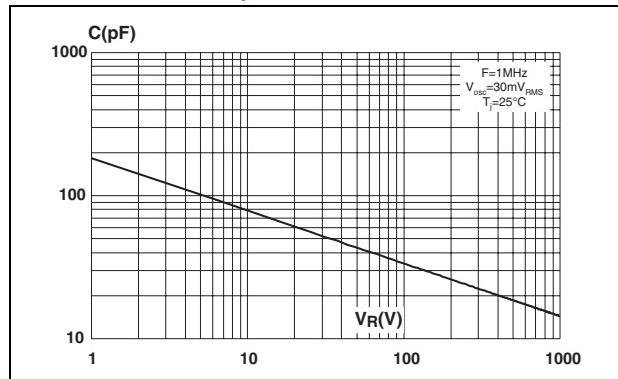
**Figure 9. Transient peak forward voltage versus  $dI_F/dt$  (typical values)**



**Figure 10. Forward recovery time versus  $dI_F/dt$  (typical values)**



**Figure 11. Junction capacitance versus reverse voltage applied (typical values)**



## 2 Package information

Epoxy meets UL94, V0

Cooling method: by conduction (C)

Recommended torque value: 0.55 Nm (TO-220AC)

Recommended torque value: 0.80 Nm (SOD93, DOP31, and DO-247)

Maximum torque value: 0.7 Nm (TO-220AC)

Maximum torque value: 1.0 Nm (SOD93, DOP31, and DO-247)

**Table 5. DO-247 dimensions**

REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.		Max	Min.		Max.
A	4.85		5.15	0.191		0.203
D	2.20		2.60	0.086		0.102
E	0.40		0.80	0.015		0.031
F	1.00		1.40	0.039		0.055
F2		2.00			0.078	
F3	2.00		2.40	0.078		0.094
G		10.90			0.429	
H	15.45		15.75	0.608		0.620
L	19.85		20.15	0.781		0.793
L1	3.70		4.30	0.145		0.169
L2		18.50			0.728	
L3	14.20		14.80	0.559		0.582
L4		34.60			1.362	
L5		5.50			0.216	
M	2.00		3.00	0.078		0.118
V		5°			5°	
V2		60°			60°	
Dia.	3.55		3.65	0.139		0.143

Table 6. T0-220AC dimensions

REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam. I	3.75	3.85	0.147	0.151

**Table 7.** DOP3I dimensions

REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
b	1.20	1.40	0.047	0.055
c	1.45	1.55	0.057	0.061
c1	0.50	0.70	0.020	0.028
D	12.15	13.10	0.474	0.516
E	15.10	15.50	0.594	0.610
E1	7.55	7.75	0.297	0.305
e	10.80	11.30	0.425	0.445
G	20.4	21.10	0.815	0.831
L	14.35	15.60	0.565	0.614
P	4.08	4.17	0.161	0.164
Q	2.70	2.90	0.106	0.114
R	4.60 typ.		0.181 typ.	
Y	15.80	16.50	0.622	0.650

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

### 3 Ordering information

Part Number	Marking	Package	Weight	Base qty	Delivery mode
STTH3010D	STTH3010D	TO-220AC	1.86 g	50	Tube
STTH3010PI	STTH3010PI	DOP3I	4.46 g	30	Tube
STTH3010W	STTH3010W	DO-247	4.4 g	30	Tube

### 4 Revision history

Date	Revision	Description of Changes
02-Mar-2006	1	First issue.

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